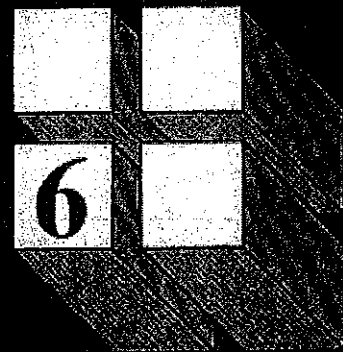
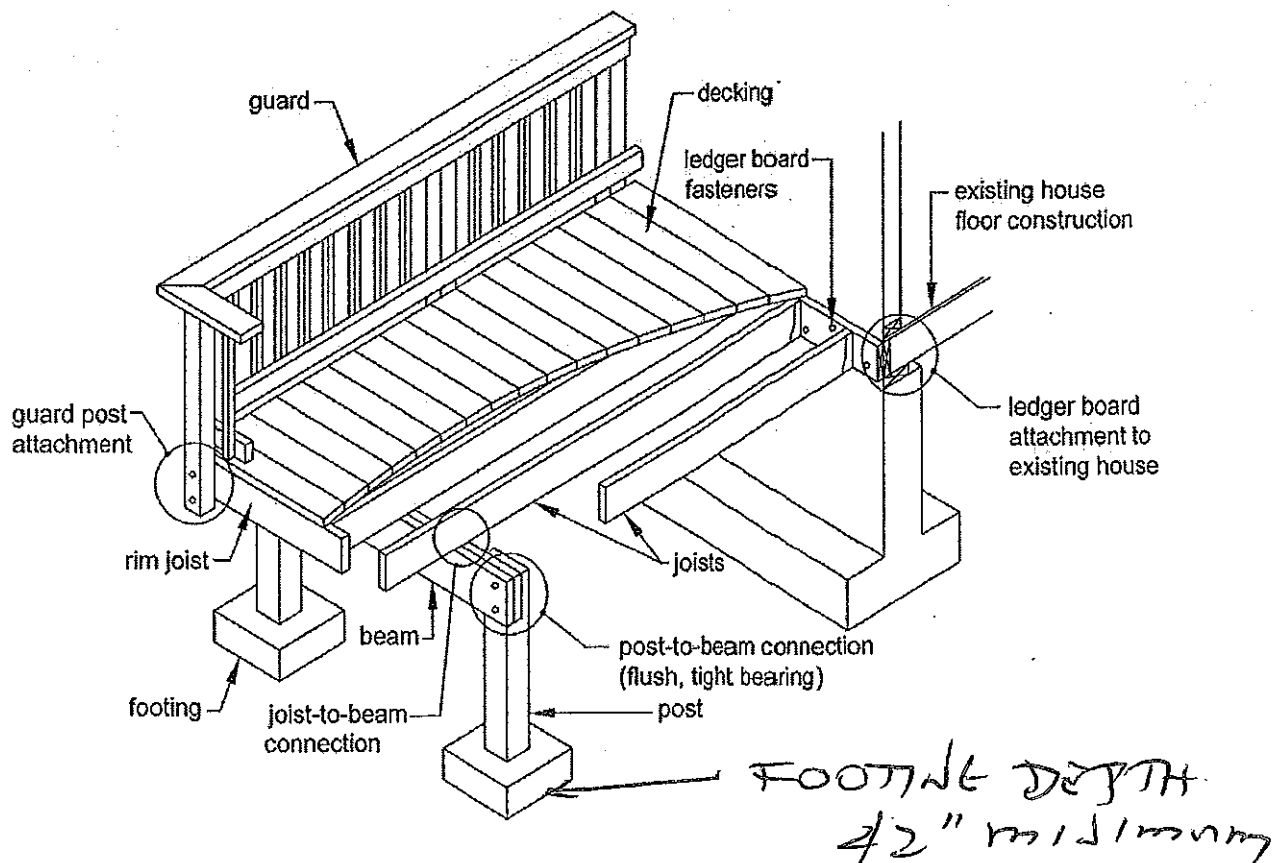


Design for Code Acceptance



Prescriptive Residential Wood Deck Construction Guide

Based on the 2009 International Residential Code



Where applicable, provisions and details contained in this document are based on the *International Residential Code (IRC)* [bracketed text references applicable sections of the *IRC*]. Prescriptive construction methods recommended meet or exceed minimum requirements of the *IRC*. Provisions that are not found in the *IRC* are recommended as good industry practice. Where differences exist between provisions of this document and the *IRC*, provisions of the *IRC* shall apply. This document is not intended to preclude the use of other construction methods or materials. All construction and materials must be approved by the authority having jurisdiction. Every effort has been made to reflect the language and intent of the *IRC*. However, no assurance can be given that designs and construction made in accordance with this document meet the requirements of any particular jurisdiction.

CONTENTS

MINIMUM REQUIREMENTS.....	2	PROHIBITED LEDGER ATTACHMENTS.....	12
DECKING REQUIREMENTS.....	3	LEDGER BOARD FASTENERS.....	12
JOIST SIZE.....	3	FREE-STANDING DECKS.....	14
BEAM SIZE & ASSEMBLY REQUIREMENTS.....	5	DECK STABILITY.....	14
DECK FRAMING PLAN.....	6	GUARD REQUIREMENTS.....	15
JOIST-TO-BEAM CONNECTION.....	7	GUARD POST ATTACHMENTS.....	16
JOIST HANGERS.....	7	STAIR REQUIREMENTS.....	17
POST REQUIREMENTS.....	7	STAIR HANDRAIL REQUIREMENTS.....	18
RIM JOIST REQUIREMENTS.....	8	STAIR FOOTING REQUIREMENTS.....	19
FOOTINGS.....	9	STAIR LIGHTING REQUIREMENTS.....	19
LEDGER ATTACHMENT REQUIREMENTS.....	10	FRAMING AT CHIMNEY OR BAY WINDOW.....	19

MINIMUM REQUIREMENTS

1. This document applies to single level residential wood decks only.
2. All lumber shall be identified by the grade mark of, or certificate of inspection issued by, an approved lumber grading or inspection bureau or agency (www.alsc.org). All lumber shall be a naturally durable species (such as Redwood or Western Cedars) or be pressure-treated with an approved process and preservative in accordance with American Wood Protection Association standards (such as but not limited to those shown in Table 1) [R317 and R318]. All lumber in contact with the ground shall be approved preservative treated wood suitable for ground contact. [R317.1.2]
3. All nails shall meet the requirements of *ASTM F 1667*. Threaded nails as stated in this document include helical (spiral) and annular (ring-shank) nails. Wood screws shall meet the requirements of *ANSI/ASME B18.6.1*. Bolts and lag screws shall meet the requirements of *ANSI/ASME B18.2.1*.
4. Throughout this document, 1/2" diameter bolts and lag screws are specified for various connections. Edge distance and spacing requirements are based on 1/2" diameter fasteners. If larger (or smaller) fasteners are specified, edge distance and spacing needs to be adjusted.
5. To resist corrosion, the following is required [R317.3]:
 - All screws, bolts, and nails for use with preservative treated wood shall be hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze, or copper. Fasteners to be hot-dipped galvanized shall meet the requirements of *ASTM A 153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*, Class D for fasteners 3/8" diameter and smaller or Class C for fasteners with diameters over 3/8".
 - Fasteners other than nails and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with *ASTM B 695*, Class 55, minimum.
 - All hardware (joist hangers, cast-in-place post anchors, etc.) shall be galvanized or shall be stainless steel. Hardware to be hot-dipped prior to fabrication shall meet *ASTM A 653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*, G-185 coating. Hardware to be hot-dipped galvanized after fabrication shall meet *ASTM A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*.
 - Fasteners and connectors exposed to salt water or located within 300 feet of a salt water shoreline shall be stainless steel grade 304 or 316.
 - Other coated or non-ferrous fasteners or hardware shall be as approved by the authority having jurisdiction.
6. Decks supporting large concentrated loads such as hot tubs are beyond the scope of this document.
7. This document does not apply to decks which will experience snow loads, snow drift loads, or sliding snow loads that exceed 40 psf. This document does not address wind or seismic design issues.
8. Flashing shall be corrosion-resistant metal [R703.8] of minimum nominal 0.019-inch thickness or approved non-metallic material. Aluminum should not be used in direct contact with lumber treated with preservatives that contain copper such as ACQ, Copper Azole, or ACZA.
9. Decks shall not be used or occupied until final inspection and approval is obtained.
10. This document is not intended to preclude the use of other construction methods or materials not shown herein.

Table 1. Common preservative treatments and retention levels (pcf) for sawn lumber in ground contact.^a

Species	ACQ-B	ACQ-C	ACQ-D	CA-B	CuN-W
Southern Pine	0.40	0.40	0.40	0.21	0.11
Douglas Fir-Larch	0.40	0.40	NR	0.21	0.11
Hem-Fir	0.40	0.40	0.40	0.21	0.11
Ponderosa Pine	0.40	0.40	0.40	0.21	0.11
Red Pine	0.40	0.40	0.40	0.21	0.11
Spruce-Pine-Fir	NR	0.40	NR	NR	NR
Redwood	NR	NR	NR	NR	NR

^a Preservatives and retentions listed in Table 1 are based on the American Wood Protection Association (AWPA) *Book of Standards*. NR = Treatments Not Recommended.

DECKING REQUIREMENTS

All decking material shall be composed of dimension lumber (2" nominal thickness) or span rated decking in accordance with the American Lumber Standard Committee *Policy for Evaluation of Recommended Spans for Span Rated Decking Products* (November 5, 2004). Attach decking to each joist with 2-8d threaded nails or 2-#8 screws. Space decking boards approximately $\frac{1}{8}$ " apart. See Figure 11 for decking connection requirements at the rim joist. Decking may be placed from an angle perpendicular to the joists to an angle of 45 degrees to the joists. Each segment of decking must bear on a minimum of 4 joists (or 4 supports).

Decking not meeting these requirements may be substituted when the product has been approved by the authority having jurisdiction.

JOIST SIZE

The span of a joist is measured from the centerline of bearing at one end of the joist to the centerline of bearing at the other end of the joist and does not include the length of the overhangs. Use Table 2 to determine joist span based on lumber size and joist spacing. See Figure 1 and Figure 2 for joist span types.

Table 2. Maximum Joist Spans (L_j)

Species	Size	Joist Spacing (o.c.)					
		Without Overhangs ¹			With Overhangs up to L _j /4 ²		
		12"	16"	24"	12"	16"	24"
Southern Pine	2x8	13' - 8"	12' - 5"	10' - 2"	10' - 9"	10' - 9"	10' - 2"
	2x10	17' - 5"	15' - 10"	13' - 1"	15' - 6"	15' - 6"	13' - 1"
	2x12	18' - 0"	18' - 0"	15' - 5"	18' - 0"	18' - 0"	15' - 5"
Douglas Fir-Larch, Hem-Fir, SPF ³	2x8	12' - 6"	11' - 1"	9' - 1"	9' - 5"	9' - 5"	9' - 1"
	2x10	15' - 8"	13' - 7"	11' - 1"	13' - 7"	13' - 7"	11' - 1"
	2x12	18' - 0"	15' - 9"	12' - 10"	18' - 0"	15' - 9"	12' - 10"
Redwood, Western Cedars, Ponderosa Pine ⁴ , Red Pine ⁴	2x8	11' - 8"	10' - 7"	8' - 8"	8' - 6"	8' - 6"	8' - 6"
	2x10	14' - 11"	13' - 0"	10' - 7"	12' - 3"	12' - 3"	10' - 7"
	2x12	17' - 5"	15' - 1"	12' - 4"	16' - 5"	15' - 1"	12' - 4"

1. Assumes 40 psf live load, 10 psf dead load, L/360 deflection, No. 2 grade, and wet service conditions. See Figure 1B.

2. Assumes 40 psf live load, 10 psf dead load, L/180 cantilever deflection with 220 lb point load, No. 2 grade, and wet service conditions. See Figure 1A and Figure 2.

3. Incising assumed for refractory species including Douglas fir-larch, hem-fir, and spruce-pine-fir.

4. Design values based on northern species with no incising assumed.

Figure 1A. Joist Span – Deck Attached at House and Bearing Over Beam

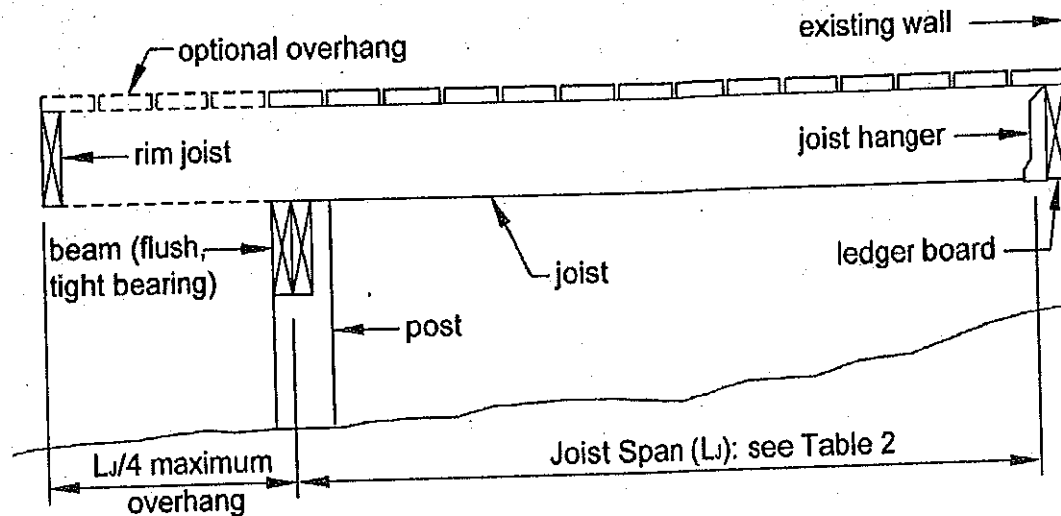


Figure 1B. Joist Span – Joists Attached at House and to Side of Beam

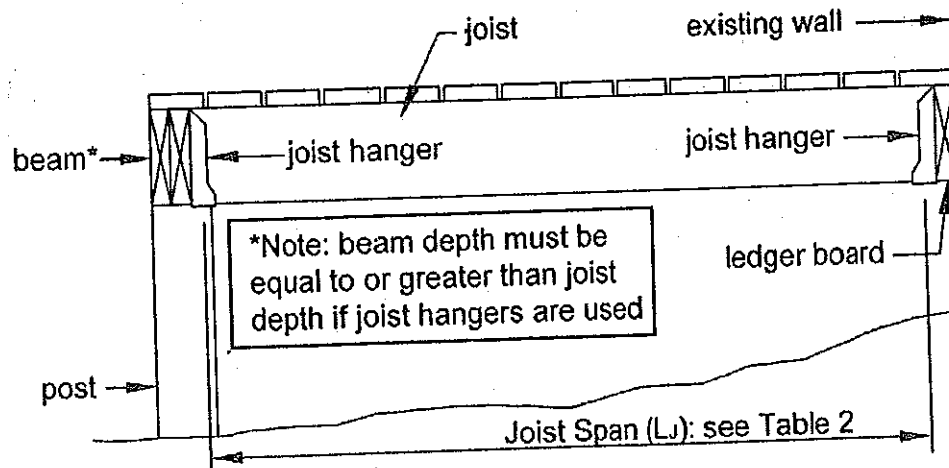
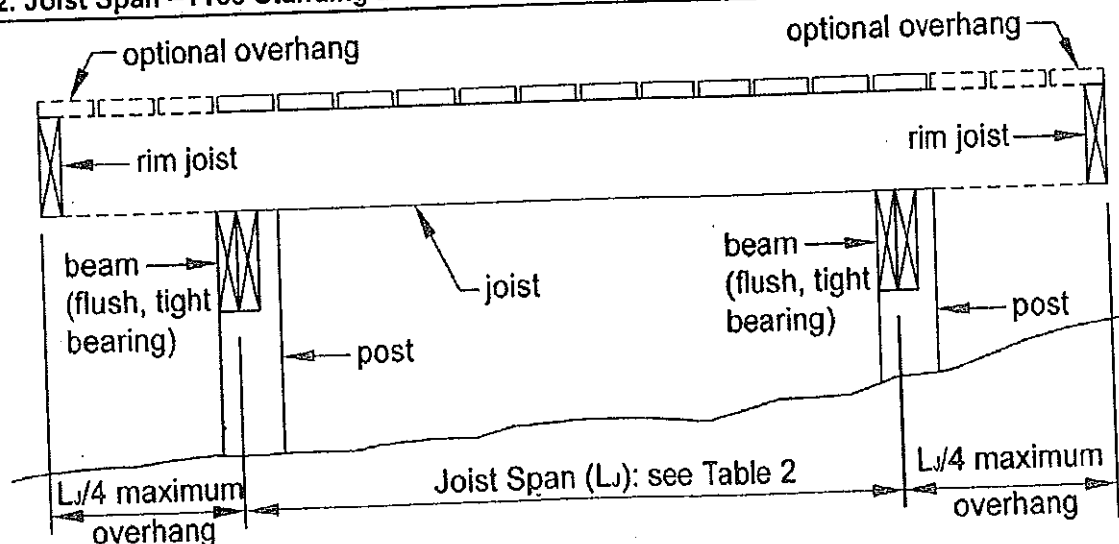


Figure 2. Joist Span – Free Standing Deck



BEAM SIZE & ASSEMBLY REQUIREMENTS

Deck beam spans shall be in accordance with Table 3 and can extend past the post centerline up to $L_B/4$ as shown in Figure 3. Joists may bear on the beam and extend past the beam centerline up to $L_J/4$ as shown in Figures 1A and 2, or the joists may attach to the side of the beam with joist hangers as shown in Figure 1B.

Joists shall not frame in from opposite sides of the same beam. See JOIST-TO-BEAM CONNECTION details, Figure 6.

Where multiple 2x members are used, the deck's beam is assembled by attaching the members identified in Table 3 in accordance with Figure 4. [Table R602.3(1)]

Table 3. Deck Beam Spans (L_B)¹ for Joists Framing from One Side Only

Species	Size ⁴	Joist Spans (L_J) Less Than or Equal to:						
		6'	8'	10'	12'	14'	16'	18'
Southern Pine	2-2x6	7' - 1"	6' - 2"	5' - 6"	5' - 0"	4' - 8"	4' - 4"	4' - 1"
	2-2x8	9' - 2"	7' - 11"	7' - 1"	6' - 6"	6' - 0"	5' - 7"	5' - 3"
	2-2x10	11' - 10"	10' - 3"	9' - 2"	8' - 5"	7' - 9"	7' - 3"	6' - 10"
	2-2x12	13' - 11"	12' - 0"	10' - 9"	9' - 10"	9' - 1"	8' - 6"	8' - 0"
	3-2x6	8' - 7"	7' - 8"	6' - 11"	6' - 3"	5' - 10"	5' - 5"	5' - 2"
	3-2x8	11' - 4"	9' - 11"	8' - 11"	8' - 1"	7' - 6"	7' - 0"	6' - 7"
	3-2x10	14' - 5"	12' - 10"	11' - 6"	10' - 6"	9' - 9"	9' - 1"	8' - 7"
	3-2x12	17' - 5"	15' - 1"	13' - 6"	12' - 4"	11' - 5"	10' - 8"	10' - 1"
	3x6 or 2-2x6	5' - 5"	4' - 8"	4' - 2"	3' - 10"	3' - 6"	3' - 1"	2' - 9"
Douglas Fir-Larch ² , Hem-Fir ² , SPF ² , Redwood, Western Cedars, Ponderosa Pine ³ , Red Pine ³	3x8 or 2-2x8	6' - 10"	5' - 11"	5' - 4"	4' - 10"	4' - 6"	4' - 1"	3' - 8"
	3x10 or 2-2x10	8' - 4"	7' - 3"	6' - 6"	5' - 11"	5' - 6"	5' - 1"	4' - 8"
	3x12 or 2-2x12	9' - 8"	8' - 5"	7' - 6"	6' - 10"	6' - 4"	5' - 11"	5' - 7"
	4x6	6' - 5"	5' - 6"	4' - 11"	4' - 6"	4' - 2"	3' - 11"	3' - 8"
	4x8	8' - 5"	7' - 3"	6' - 6"	5' - 11"	5' - 6"	5' - 2"	4' - 10"
	4x10	9' - 11"	8' - 7"	7' - 8"	7' - 0"	6' - 6"	6' - 1"	5' - 8"
	4x12	11' - 5"	9' - 11"	8' - 10"	8' - 1"	7' - 6"	7' - 0"	6' - 7"
	3-2x6	7' - 4"	6' - 8"	6' - 0"	5' - 6"	5' - 1"	4' - 9"	4' - 6"
	3-2x8	9' - 8"	8' - 6"	7' - 7"	6' - 11"	6' - 5"	6' - 0"	5' - 8"
	3-2x10	12' - 0"	10' - 5"	9' - 4"	8' - 6"	7' - 10"	7' - 4"	6' - 11"
	3-2x12	13' - 11"	12' - 1"	10' - 9"	9' - 10"	9' - 1"	8' - 6"	8' - 1"

1. Assumes 40 psf live load, 10 psf dead load, $L/360$ simple span beam deflection limit, $L/180$ cantilever deflection limit, No. 2 grade, and wet service conditions.
2. Incising assumed for refractory species including Douglas fir-larch, hem-fir, and spruce-pine-fir.
3. Design values based on northern species with no incising assumed.
4. Beam depth must be equal to or greater than joist depth if joist hangers are used (see Figure 6, Option 3).

Figure 3: Beam Span Types

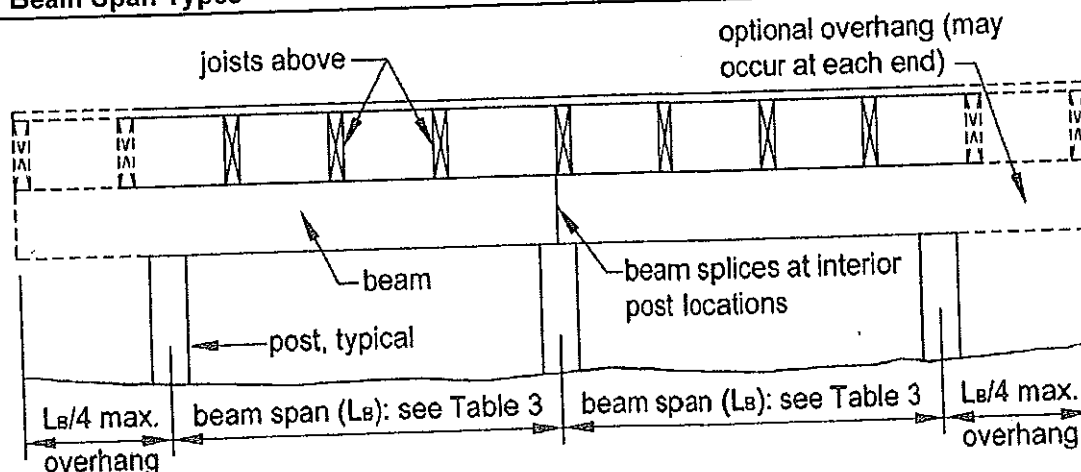
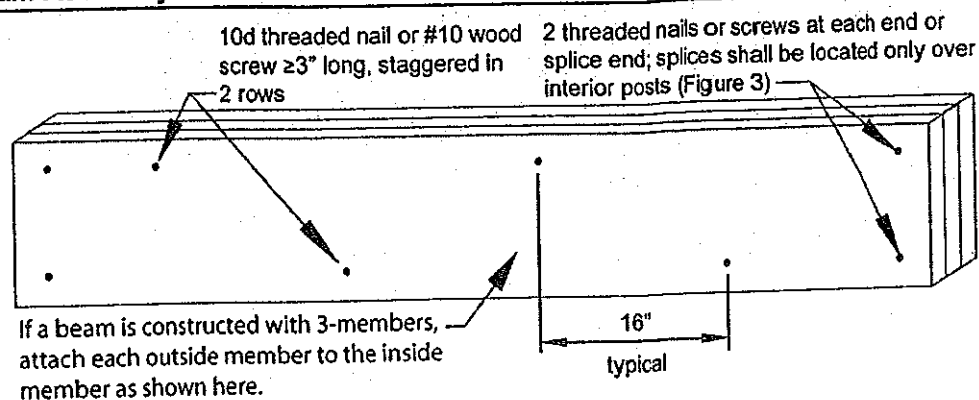
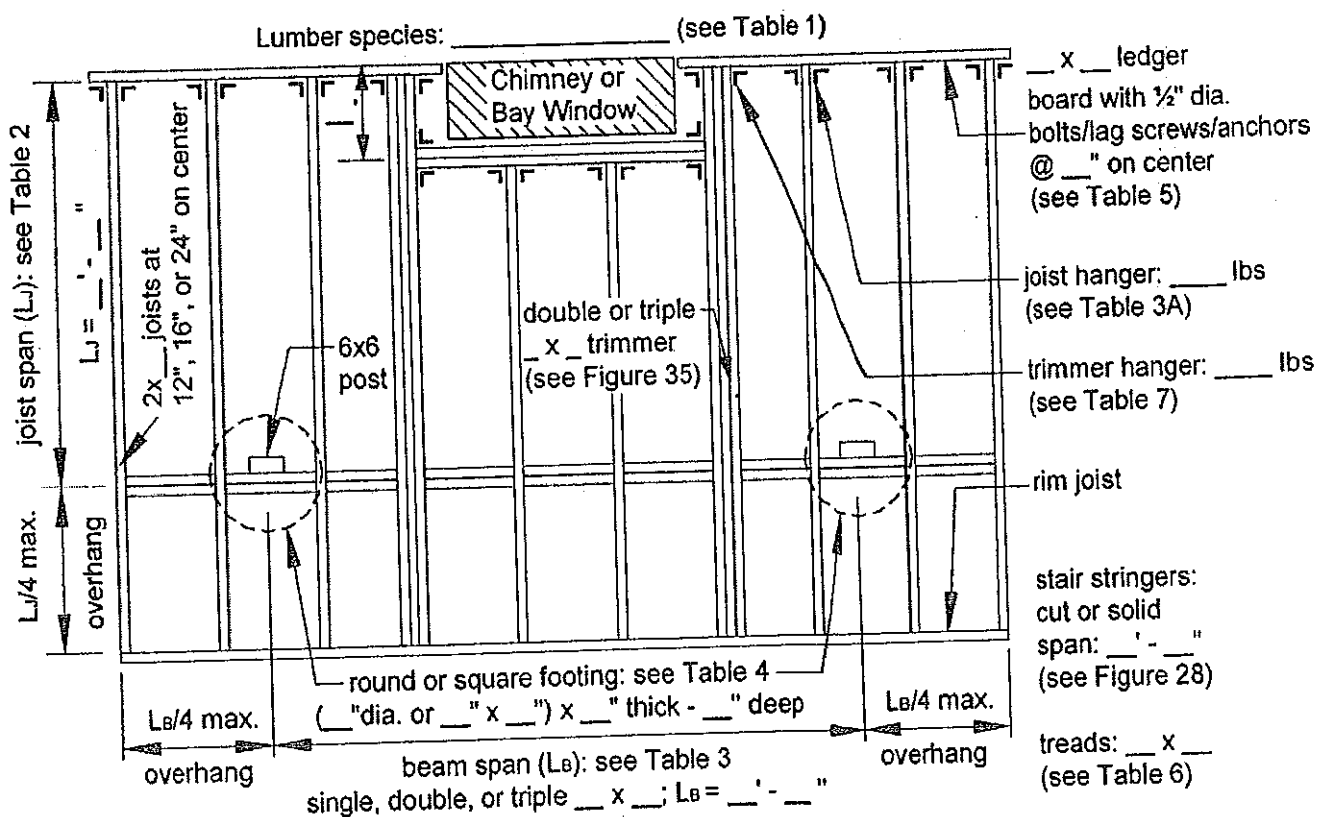


Figure 4. Beam Assembly Details

**DECK FRAMING PLAN**

A framing plan shows the joist and beam layout; the location of the ledger board, posts, and footings, and the type, size, and spacing of the ledger board fasteners. See Figure 5 for an example of a typical deck framing plan.

Figure 5. Typical Deck Framing Plan

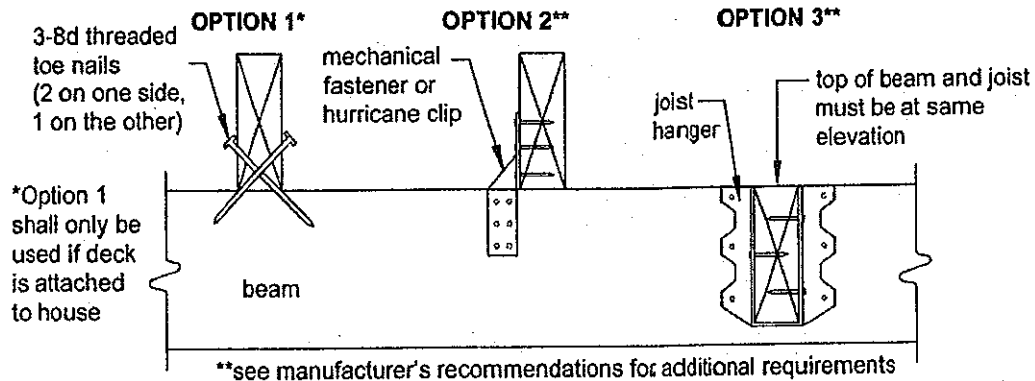


JOIST-TO-BEAM CONNECTION

Each joist shall be attached to the beam as shown in Figure 6. Joists may bear on and overhang past the beam a maximum of $L_j/4$. Use Option 1 or Option 2 to attach the joist to the beam. Option 1 shall only be used if the deck is attached to the house with a ledger (see LEDGER ATTACHMENT REQUIREMENTS) or as shown in Figure 23. Mechanical fasteners or hurricane

clips used as shown in Option 2 must have a minimum capacity of 100 lbs in both uplift and lateral load directions. Joists may also attach to the side of the beam with joist hangers per Option 3. Joists shall not frame in from opposite sides of the same beam. See JOIST HANGERS for more information. Hangers, clips, and mechanical fasteners shall be galvanized or stainless steel (see MINIMUM REQUIREMENTS).

Figure 6: Joist-to-Beam Detail



JOIST HANGERS

Joist hangers, as shown in Figure 7, shall each have a minimum download capacity in accordance with Table 3A. The joist hanger shall be selected from an approved manufacturer's product data based on the dimensions of the joist or header it is carrying. Joist hangers shall be galvanized or stainless steel (see MINIMUM REQUIREMENTS).

Use joist hangers with inside flanges when clearances to the edge of the beam or ledger board dictate. Do not use clip angles or brackets to support joists.

Figure 7: Typical Joist Hangers

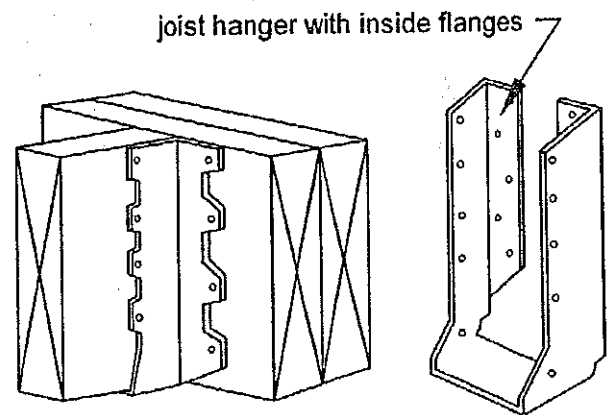


Table 3A: Joist Hanger Download Capacity

Joist Size	Minimum Capacity, lbs
2x8	600
2x10	700
2x12	800

POST REQUIREMENTS

All deck post sizes shall be 6x6 (nominal) or larger, and the maximum height shall be 14'-0" measured to the underside of the beam. Posts shall be centered on footings. Cut ends of posts shall be field treated with an approved preservative (such as copper naphthenate) [R402.1.2]. The beam shall be attached to the post by

notching the 6x6 as shown in Figure 8 or by providing an approved post cap to connect the beam and post as shown in Figure 10. All 3-ply beams shall be connected to the post by a post cap. All thru-bolts shall have washers under the bolt head and nut. Attachment of the beam to the side of the post without notching is prohibited (see Figure 9).

Figure 8. Post-to-Beam Attachment Requirements

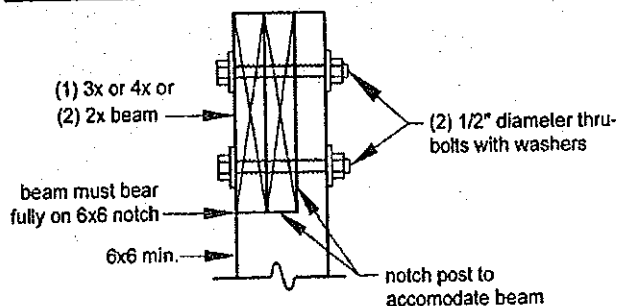
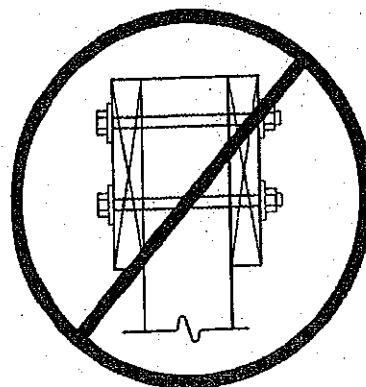


Figure 9. Prohibited Post-to-Beam Attachment Condition



RIM JOIST REQUIREMENTS

Attach a continuous rim joist to the ends of joists as shown in Figure 11. Attach decking to the rim joist as shown in Figure 11. For more decking attachment requirements, see **DECKING REQUIREMENTS**.

Figure 10. Alternate Approved Post-to-Beam Post Cap Attachment

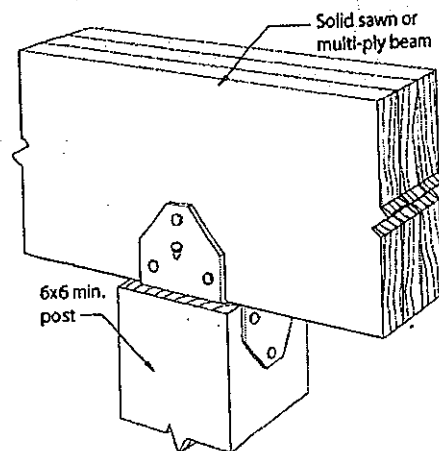
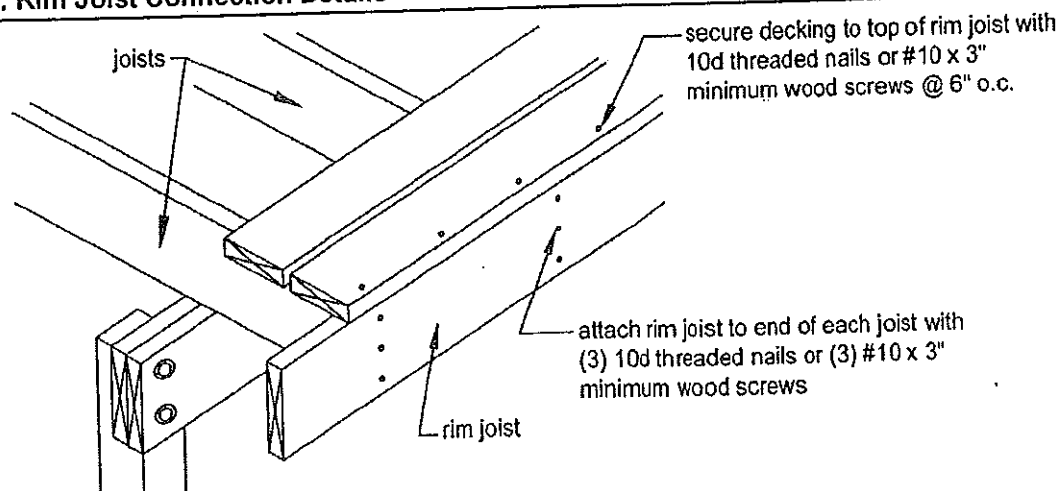


Figure 11. Rim Joist Connection Details



FOOTINGS [R403]

See Figure 12 and Table 4 for footing size, footing thickness, and post attachment options and requirements. All footings shall bear on solid ground and shall be placed at least 12 inches below the undisturbed ground surface or below the frost line, whichever is deeper. Contact the authority having jurisdiction to determine the specified frost line. Bearing conditions shall be verified in the field by the building official prior to placement of concrete. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation. DECK FOOTINGS CLOSER THAN 5'-0" TO AN EXISTING EXTERIOR HOUSE WALL MUST BEAR AT THE SAME ELEVATION AS THE FOOTING OF THE EXISTING HOUSE FOUNDATION.

Do not construct footings over utility lines or enclosed meters. Contact local utilities (call 811) before digging.

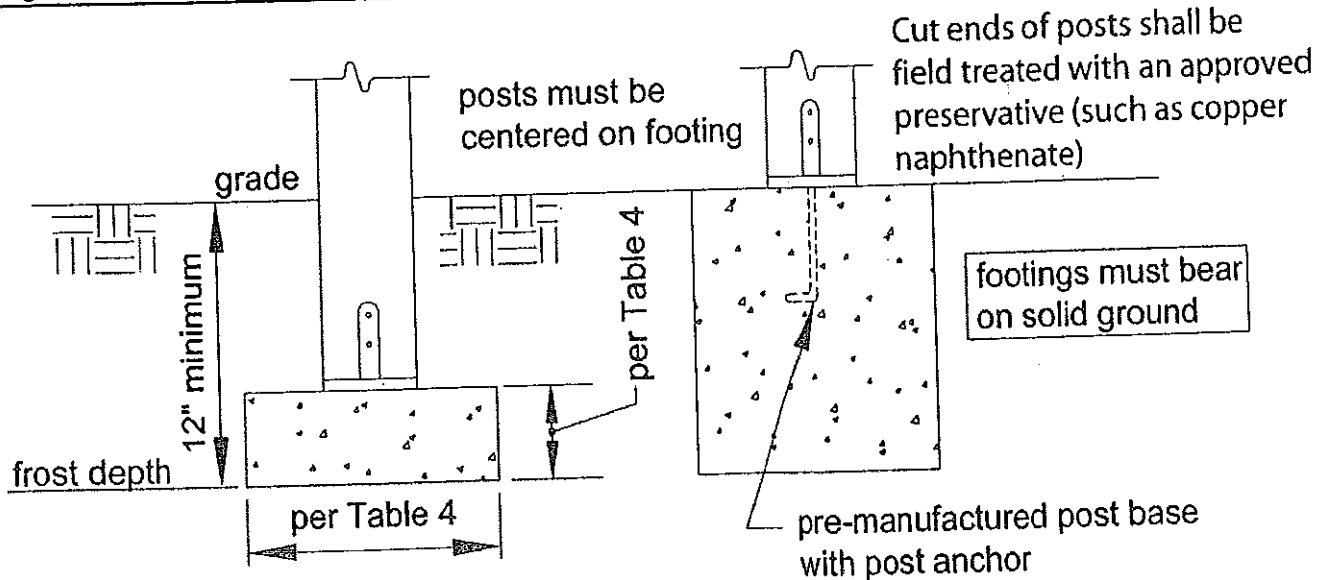
Pre-manufactured post anchors shall be galvanized. See MINIMUM REQUIREMENTS.

Table 4. Footing Sizes¹

Beam Span, L _B	Jolst Span, L _J	Round Footing Diameter	Square Footing Dimension	Footing Thickness ²
6'	<10'	15"	13"	6"
	<14'	17"	15"	6"
	<18'	20"	18"	7"
8'	<10'	17"	15"	6"
	<14'	20"	18"	8"
	<18'	23"	21"	9"
10'	<10'	19"	17"	7"
	<14'	22"	20"	9"
	<18'	25"	23"	10"
12'	<10'	21"	19"	8"
	<14'	24"	22"	10"
	<18'	28"	26"	11"
14'	<10'	22"	20"	9"
	<14'	26"	24"	11"
	<18'	30"	28"	12"
16'	<10'	24"	22"	9"
	<14'	28"	26"	12"
	<18'	32"	30"	13"
18'	<10'	25"	23"	10"
	<14'	30"	28"	12"
	<18'	34"	32"	14"

- Assumes 1,500 psf soil bearing capacity.
- Assumes 2,500 psi compressive strength of concrete. Coordinate footing thickness with post base and anchor requirements.

Figure 12. Typical Footing Options



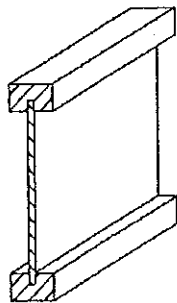
LEDGER ATTACHMENT REQUIREMENTS**[R502.2.2]**

GENERAL: Attach the ledger board, which shall be equal to or greater than the deck joist depth but less than or equal to the rim joist depth, to the existing exterior wall in accordance with Figure 14 through Figure 16. When attachments are made to the existing house band joist, the band joist shall be capable of supporting the new deck. If this cannot be verified or conditions at the existing house differ from the details herein, then either a free-standing deck or full plan submission is required. See **FREE-STANDING DECKS**.

SIDING AND FLASHING: House siding or the exterior finish system must be removed prior to installation of the ledger board. Approved corrosion resistant flashing is required at any ledger board connection to a wall of wood framed construction (see **MINIMUM REQUIREMENTS**). See Figure 14 for continuous flashing with drip edge. The threshold shall be carefully flashed and caulked to prevent water intrusion due to splash from the deck or melting snow and ice.

MANUFACTURED WOOD I-JOIST: The term "I-Joist" denotes manufactured wood "I" joists (see Figure 13A). Many new homes constructed with wood I-joists

Figure 13A. Wood I-Joist Profile



include 1" or thicker engineered wood products (EWP) – such as oriented strand board (OSB) or structural composite lumber (SCL) including laminated veneer lumber (LVL) – as band joists (or rim boards) that can support the attachment of a deck (see Figure 14). However, some older homes might be constructed with band boards that are too thin (less than 1") to support a deck. In such cases, a free-standing deck or a full plan submission is required.

MANUFACTURED WOOD TRUSS: A metal plate connected wood truss (MPCWT) is an engineered, prefabricated structural component designed for each specific application. MPCWT's used in residential floors are often installed with a 2x4 lumber "ribbon" at the ends of the trusses (see Figure 13B) to tie the ends of the trusses together. The ribbon board, by itself, is not intended to support the deck ledger and deck. Installing residential decks when the floor system for the house uses MPCWT requires a standard detail provided by the truss designer, a free-standing deck, or a full plan submission. Refer to the WTCA Technical Note – *Attachment of Residential Decks to Wood Truss Floor Systems* for special blocking details and attachment requirements (www.sbcindustry.com).

Figure 13B. Metal Plate Connected (MPC) Wood Floor Trusses with a 2x4 Lumber "Ribbon" at the Ends of the Trusses

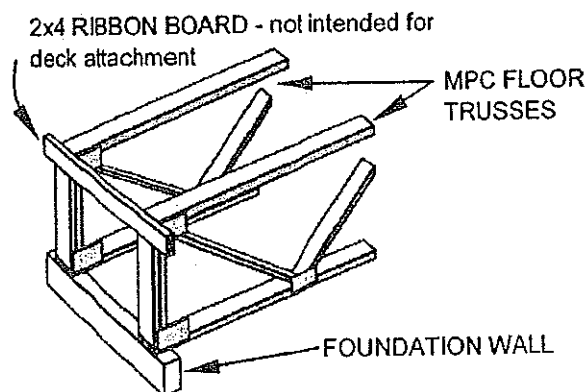


Figure 14. General Attachment of Ledger Board to Band Joist or Rim Board

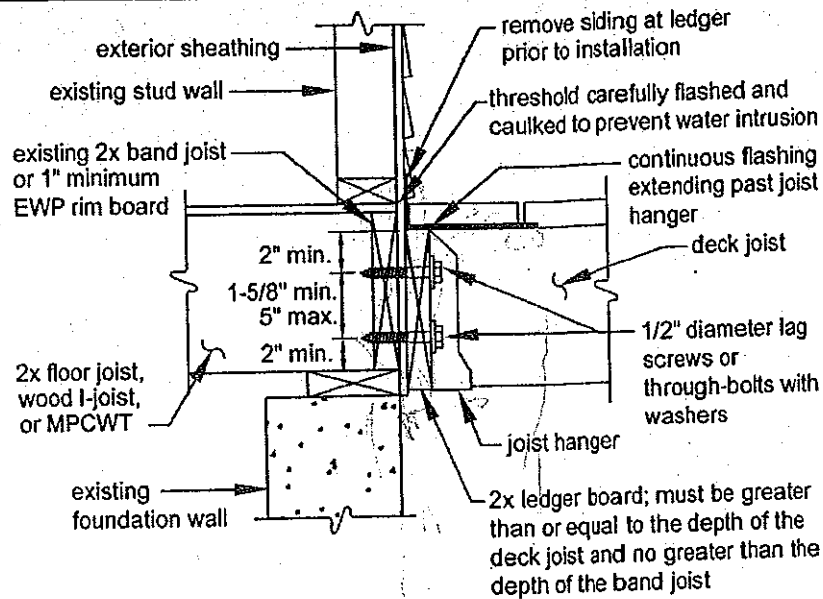


Figure 15. Attachment of Ledger Board to Foundation Wall (Concrete or Solid Masonry)

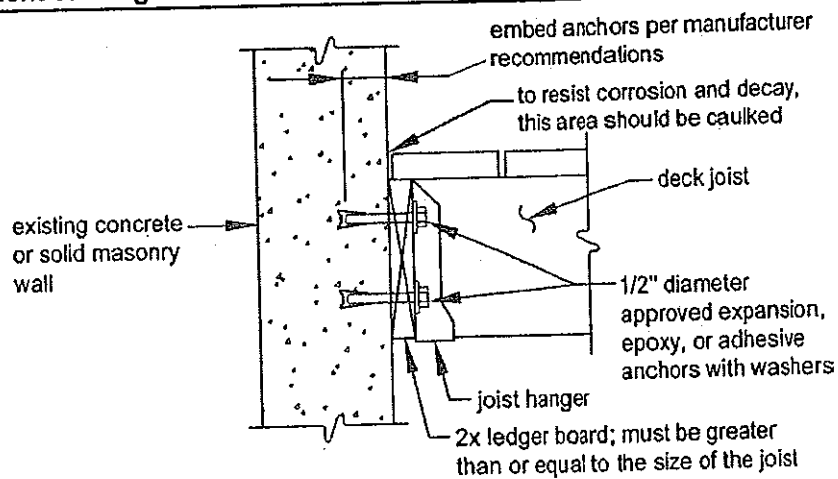
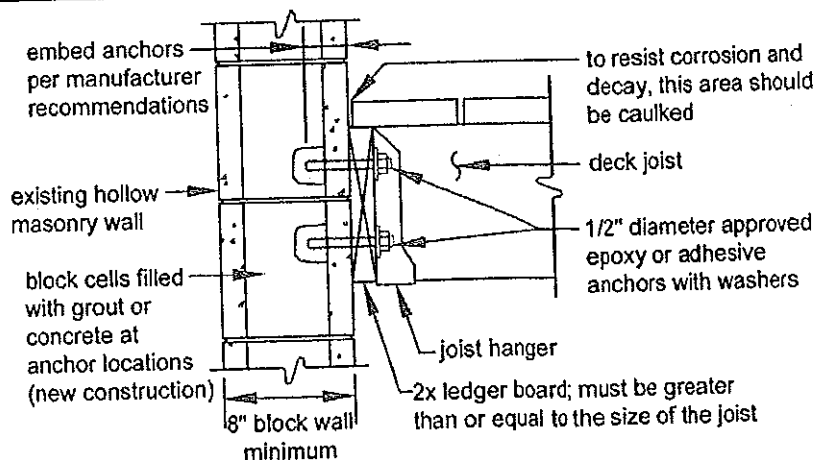


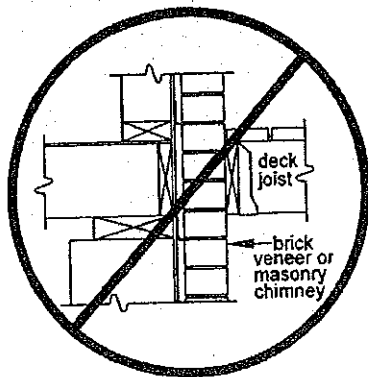
Figure 16. Attachment of Ledger Board to Foundation Wall (Hollow Masonry)



PROHIBITED LEDGER ATTACHMENTS

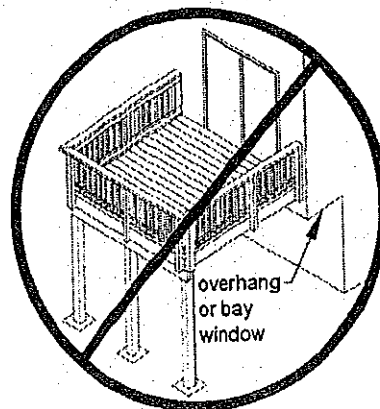
Attachments to exterior veneers (brick, masonry, stone) and to cantilevered floor overhangs or bay windows are prohibited (see Figures 17 and 18). In such cases the

Figure 17: No Attachment to or Through Exterior Veneers (Brick, Masonry, Stone)



deck shall be free-standing (see FREE-STANDING DECKS).

Figure 18: No Attachment to House Overhang

**LEDGER BOARD FASTENERS**

Only those fasteners noted below are permitted. LEAD ANCHORS ARE PROHIBITED.

Deck ledger connection to band joist or rim board.
The connection between a deck ledger and a 2-inch nominal lumber band joist (1-1/2" actual) or EWP rim board bearing on a sill plate or wall plate shall be constructed with 1/2" lag screws or bolts with washers per Table 5 and Figure 19 (see MINIMUM REQUIREMENTS).

Table 5. Fastener Spacing for a Southern Pine, Douglas Fir-Larch, or Hem-Fir Deck Ledger and a 2-inch Nominal Solid-Sawn Spruce-Pine-Fir Band Joist or EWP Rim Board^{3,4,5,6,8}
(Deck Live Load = 40 psf, Deck Dead Load = 10 psf)

Joist Span	Rim Board or Band Joist	6'-0" and less	6'-1" to 8'-0"	8'-1" to 10'-0"	10'-1" to 12'-0"	12'-1" to 14'-0"	14'-1" to 16'-0"	16'-1" to 18'-0"
Connection Details		On-Center Spacing of Fasteners						
1/2" diameter lag screw ¹ with 15/32" maximum sheathing	1" EWP	24"	18"	14"	12"	10"	9"	8"
	1-1/8" EWP	28"	21"	16"	14"	12"	10"	9"
	1-1/2" Lumber	30"	23"	18"	15"	13"	11"	10"
1/2" diameter bolt with 15/32" maximum sheathing	1" EWP	24"	18"	14"	12"	10"	9"	8"
	1-1/8" EWP	28"	21"	16"	14"	12"	10"	9"
	1-1/2" Lumber	36"	36"	34"	29"	24"	21"	19"
1/2" diameter bolt with 15/32" maximum sheathing and 1/2" stacked washers ^{2,7}	1-1/2" Lumber	36"	36"	29"	24"	21"	18"	16"

¹ The tip of the lag screw shall fully extend beyond the inside face of the band joist.

² The maximum gap between the face of the ledger board and face of the wall sheathing shall be 1/2".

³ Ledgers shall be flashed or caulked to prevent water from contacting the house band joist (see Figures 14, 15, and 16).

⁴ Lag screws and bolts shall be staggered per Figure 19.

⁵ Deck ledgers shall be minimum 2x8 pressure-preservative-treated No.2 grade lumber, or other approved materials as established by standard engineering practice.

⁶ When solid-sawn pressure-preservative-treated deck ledgers are attached to engineered wood products (minimum 1" thick wood structural panel band joist or structural composite lumber including laminated veneer lumber), the ledger attachment shall be designed in accordance with accepted engineering practice. Tabulated values based on 300 lbs and 350 lbs for 1" and 1-1/8" EWP rim board, respectively.

⁷ Wood structural panel sheathing, gypsum board sheathing, or foam sheathing not exceeding 1" thickness shall be permitted. The maximum distance between the face of the ledger board and the face of the band joist shall be 1".

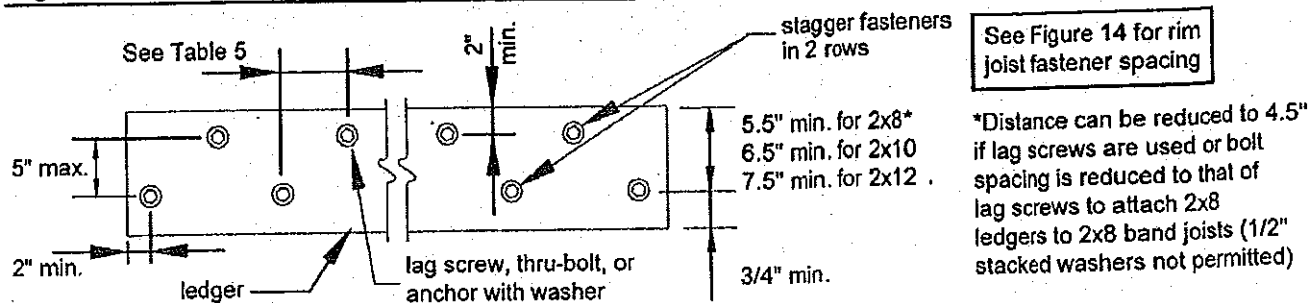
⁸ Fastener spacing also applies to southern pine, Douglas fir-larch, and hem-fir band joists.

Placement of lag screws or bolts in deck ledgers

The lag screws or bolts shall be placed as shown in Figure 19. The lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of

the deck ledger (see Figure 19). Proper installation of lag screws or bolts shall be verified by the authority having jurisdiction.

Figure 19: Ledger Board Fastener Spacing and Clearances



Thru-Bolts

Thru-bolts shall have a diameter of $\frac{1}{2}$ ". Pilot holes for thru-bolts shall be $\frac{17}{32}$ " to $\frac{9}{16}$ " in diameter. Thru-bolts require washers at the bolt head and nut.

Minimum spacing and embedment length shall be per the manufacturer's recommendations. All anchors must have washers.

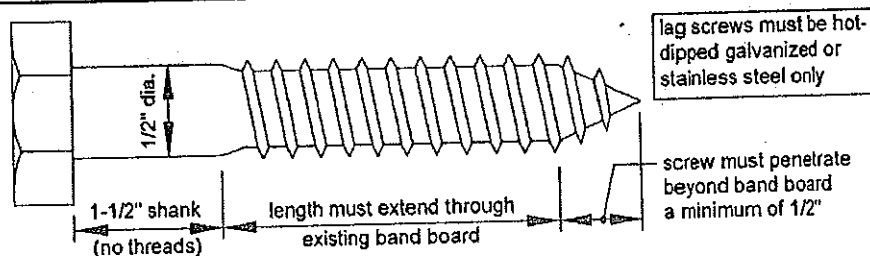
Expansion and Adhesive Anchors

Use approved expansion or adhesive anchors when attaching a ledger board to a concrete or solid masonry wall as shown in Figure 15 or a hollow masonry wall with a grouted cell as shown in Figure 16. Expansion and adhesive anchor bolts shall have a diameter of $\frac{1}{2}$ ".

Lag Screws

Lag screws shall have a diameter of $\frac{1}{2}$ " (see MINIMUM REQUIREMENTS). Lag screws may be used only when the field conditions conform to those shown in Figure 14. See Figure 20 for lag screw length and shank requirements. All lag screws shall be installed with washers.

Figure 20: Lag Screw Requirements



Lag screw installation requirements: Each lag screw shall have pilot holes drilled as follows: 1) Drill a $\frac{1}{2}$ " diameter hole in the ledger board, 2) Drill a $\frac{5}{16}$ " diameter hole into the band board of the existing house. DO NOT DRILL A $\frac{1}{2}$ " DIAMETER HOLE INTO THE BAND BOARD.

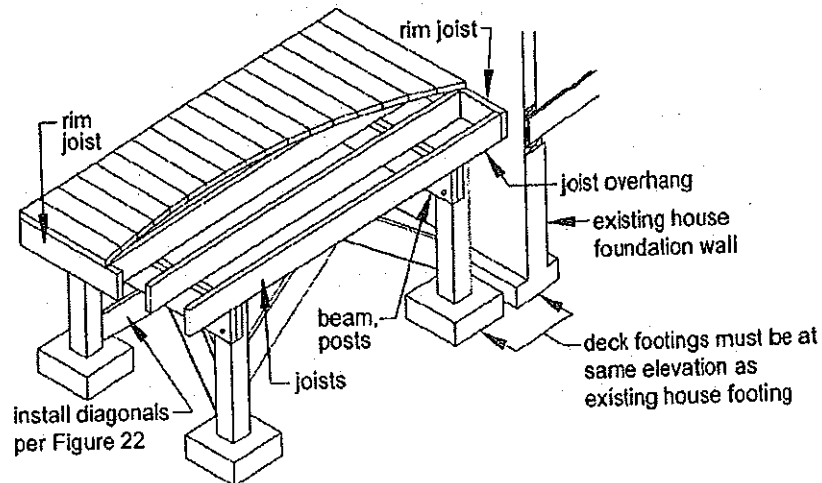
The threaded portion of the lag screw shall be inserted into the pilot hole by turning. DO NOT DRIVE LAG SCREWS WITH A HAMMER. Use soap or a wood-compatible lubricant as required to facilitate tightening. Each lag screw shall be thoroughly tightened (snug but not over-tightened to avoid wood damage).

FREE-STANDING DECKS

Decks which are free-standing do not utilize the exterior wall of the existing house to support vertical loads (see Figure 21); instead, an additional beam with posts is provided at or within $L/4$ of the existing house. THE ASSOCIATED DECK POST FOOTINGS SHALL BE PLACED AT THE SAME ELEVATION AS THE

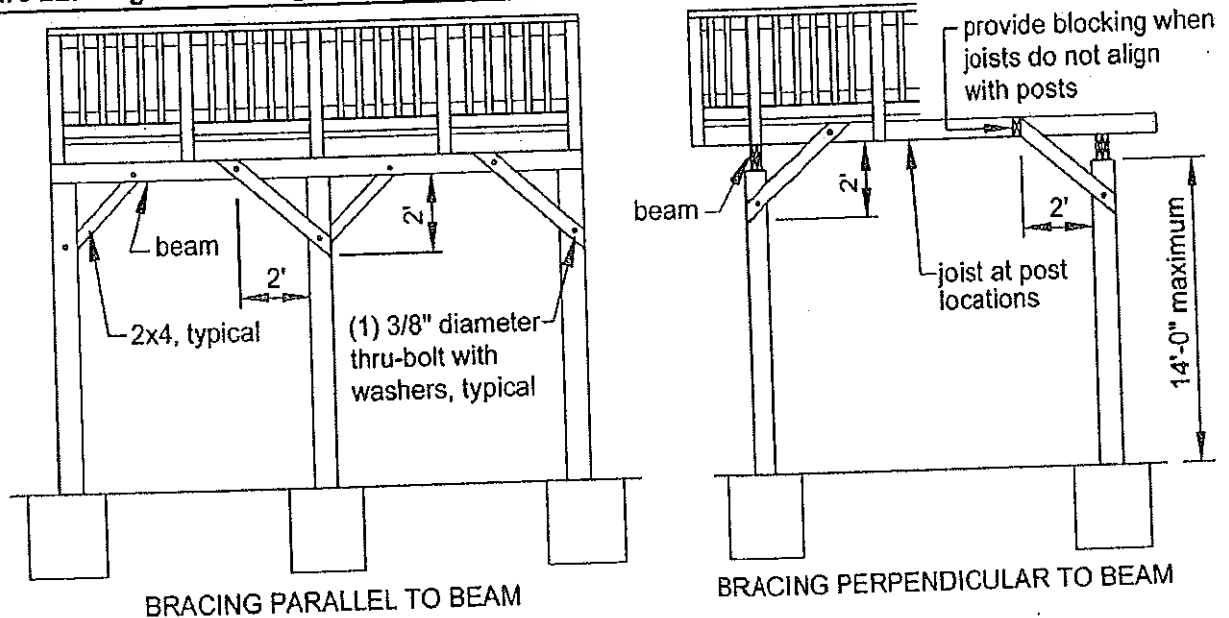
EXISTING HOUSE FOOTING IF LOCATED CLOSER THAN 5'-0" TO AN EXISTING HOUSE WALL (see Figure 2 and Figure 12). For houses with basements, a cylindrical footing (caisson) is recommended to minimize required excavation at the basement wall. Beam size is determined by Table 3.

Figure 21. Free-Standing Deck

**DECK STABILITY**

Decks greater than 2 feet above grade shall be provided with diagonal bracing.

Figure 22. Diagonal Bracing Requirements



GUARD POST ATTACHMENTS

Deck guard posts shall be a minimum 4x4 (nominal) with an adjusted bending design value not less than 1,100 psi.

Guard posts for guards which run parallel to the deck joists shall be attached to the outside joist per Figure 25. Guard posts for guards that run perpendicular to the deck

joists shall be attached to the rim joist in accordance with Figure 26. Only hold down anchor models meeting these minimum requirements shall be used. Hold down anchors shall have a minimum allowable tension load of 1,800 pounds for a 36" maximum rail height and be installed in accordance with the manufacturer's instructions.

Figure 25. Guard Post to Outside Joist Example

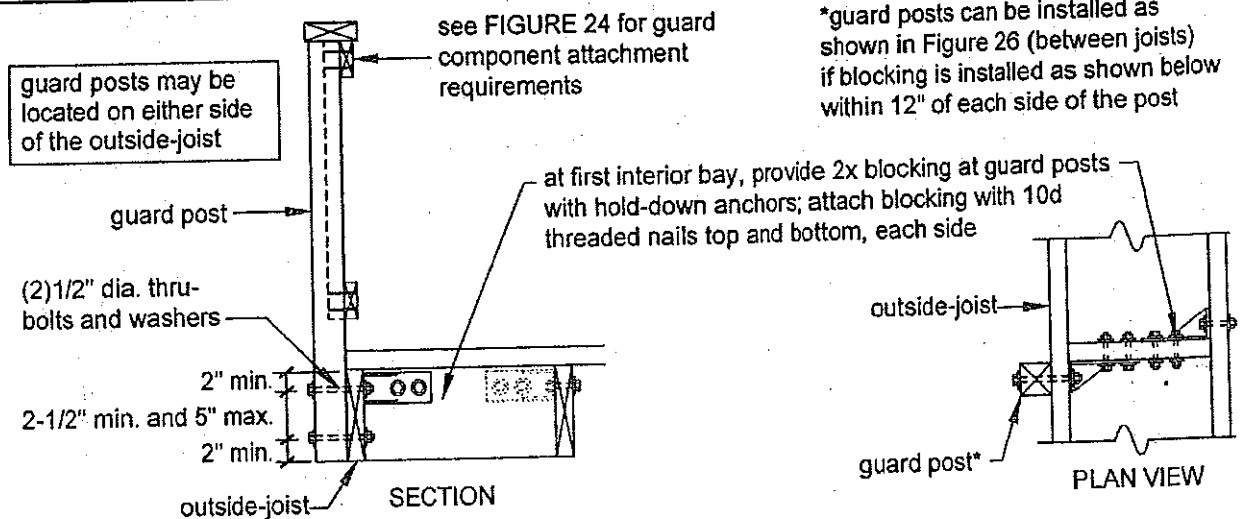
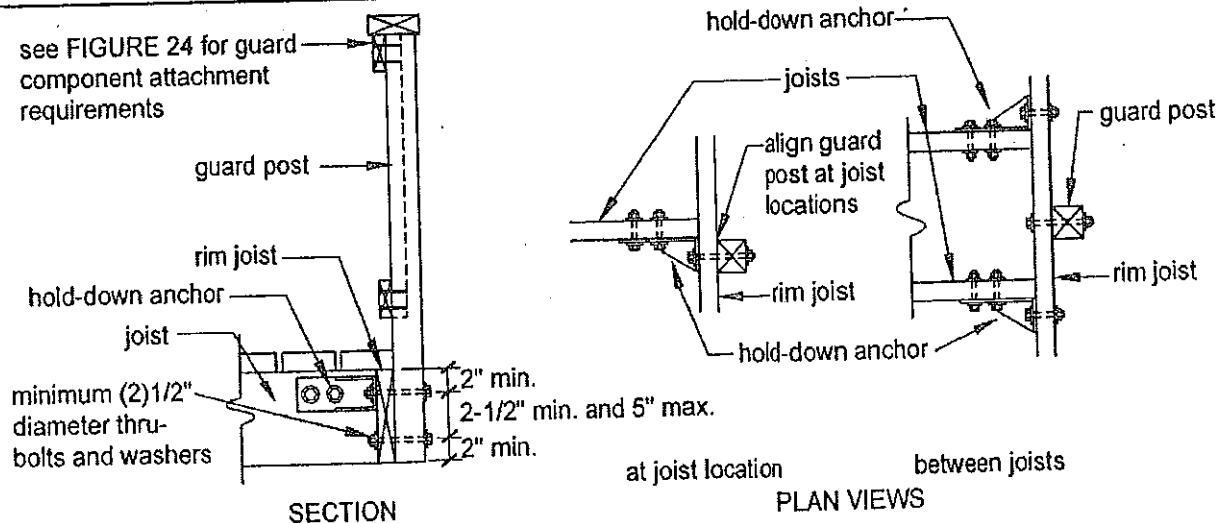


Figure 26. Guard Post to Rim Joist Example



STAIR REQUIREMENTS

Stairs, stair stringers, and stair guards shall meet the requirements shown in Figure 27 through Figure 34 and Table 6 except where amended by the local jurisdiction. All stringers shall be a minimum of 2x12. Stair stringers shall not span more than the dimensions shown in Figure 28. If the stringer span exceeds these dimensions, then a 4x4 post may be provided to support the stringer and shorten its span length. The 4x4 post shall be notched and bolted to the stringer with (2) 1/2" diameter through-bolts with washers per Figure 8. The post shall be centered on a 12" diameter or 10" square, 6" thick footing. The footing shall be constructed as shown in Figure 34 and attached to the post as shown in Figure 12. An intermediate landing may also be provided to shorten

the stringer span (see provisions below). If the total vertical height of a stairway exceeds 12'-0", then an intermediate landing shall be required. All intermediate stair landings must be designed and constructed as a free-standing deck using the details in this document. Stairs shall be a minimum of 36" in width as shown in Figure 33 [R311.7]. If only cut stringers are used, a minimum of three are required. For stairs greater than 36" in width, a combination of cut and solid stringers can be used, but shall be placed at a maximum spacing of 18" on center (see Figure 29). The width of each landing shall not be less than the width of the stairway served. Every landing shall have a minimum dimension of 36" measured in the direction of travel and no less than the width of the stairway served [R311.7].

Figure 27. Tread and Riser Detail

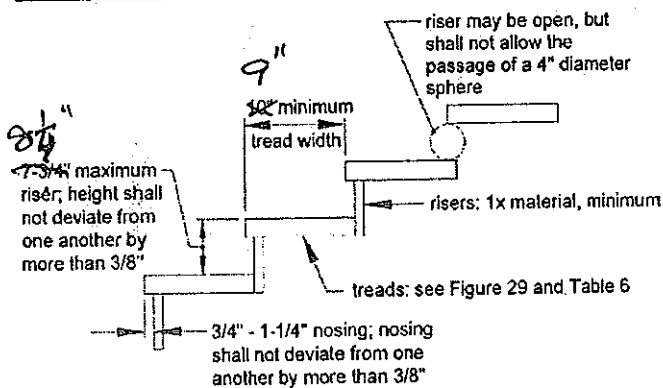


Figure 28. Stair Stringer Requirements

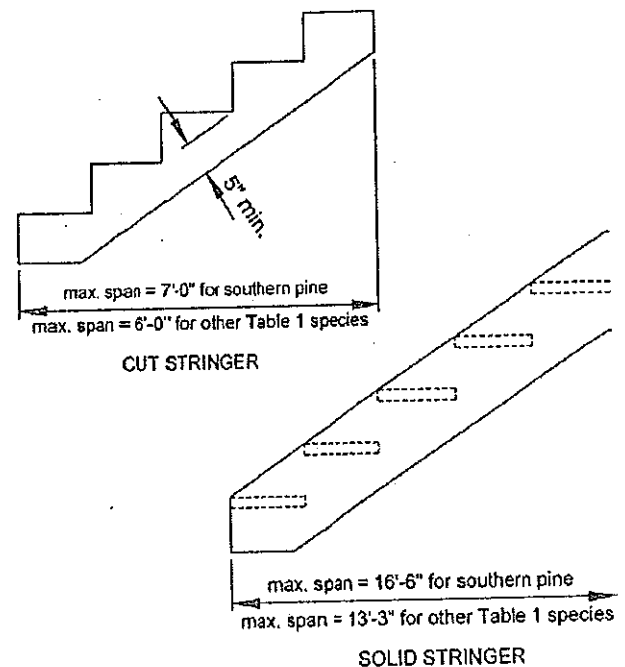


Figure 29. Tread Connection Requirements

Attachment per tread at each stringer or ledger:
 2x_ or 5/4 treads - (2)8d threaded nails or (2)#8 screws $\geq 2\text{-}1/2$ " long
 3x_ treads - (2)16d threaded nails or (2)#8 screws $\geq 3\text{-}1/2$ " long

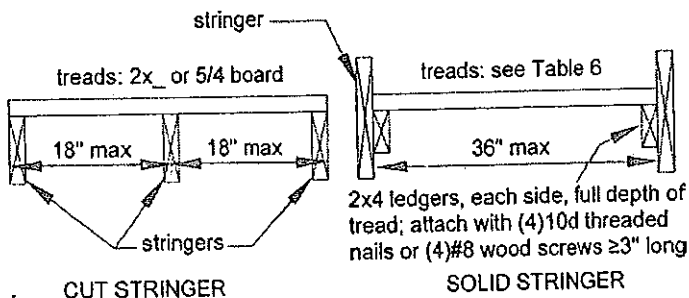


Table 6. Minimum Tread Size for Cut and Solid Stringers¹

Species	Cut Stringer	Solid Stringer
Southern Pine	2x4 or 5/4	2x6
Douglas Fir Larch, Hem-Fir, SPF ²	2x4 or 5/4	2x8 or 3x4
Redwood, Western Cedars, Ponderosa Pine ³ , Red Pine ³	2x4 or 5/4	2x10 or 3x4

- Assumes 300 lb concentrated load, L/288 deflection limit, No. 2 grade, and wet service conditions.
- Incising assumed for refractory species including Douglas fir-larch, hem-fir, and spruce-pine-fir.
- Design values based on northern species with no incising assumed.

Figure 30. Stair Guard Requirements

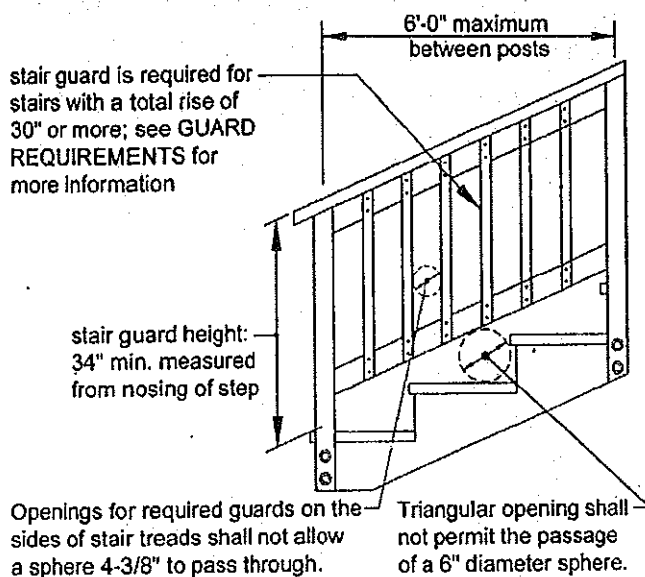
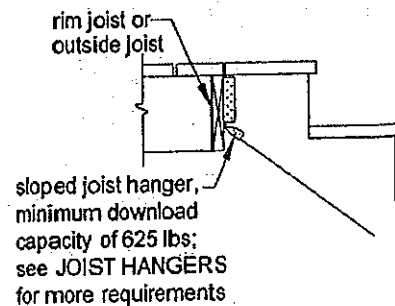


Figure 31. Stair Stringer Attachment Detail



ATTACHMENT WITH HANGERS

STAIR HANDRAIL REQUIREMENTS

All stairs with 4 or more risers shall have a handrail on at least one side (see Figure 32A) [R311.7.7]. The handrail height measured vertically from the sloped plane adjoining the tread nosing shall be not less than 34 inches and not more than 38 inches (see Figure 30) [R311.7.7.1]. Handrails shall be graspable and shall be composed of decay-resistant and/or corrosion resistant material. Handrails shall be Type I, Type II, or provide equivalent graspability (see Figure 32B). Type I shall have a perimeter dimension of at least 4" and not greater

than 6-1/4". Type II rails with a perimeter greater than 6-1/4" shall provide a graspable finger recess area on both sides of the profile [R311.7.7.3]. All shapes shall have a smooth surface with no sharp corners. Handrails shall run continuously from a point directly over the lowest riser to a point directly over the highest riser and shall return to the guard at each end (see Figure 33). Handrails may be interrupted by guard posts at a turn in the stair [R311.7.7.2].

Figure 32A. Handrail Mounting Examples

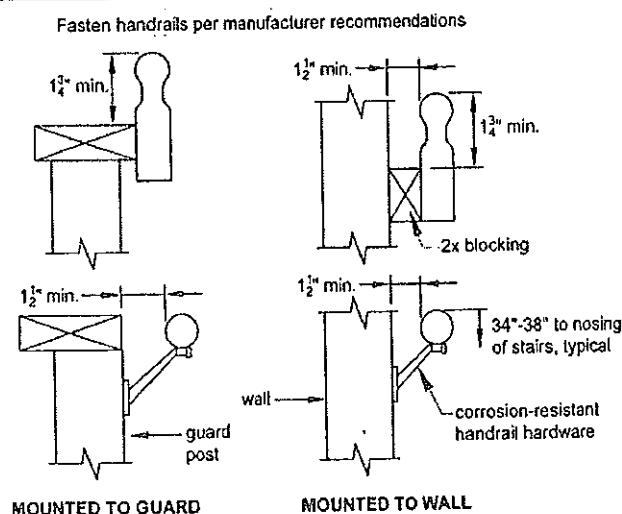
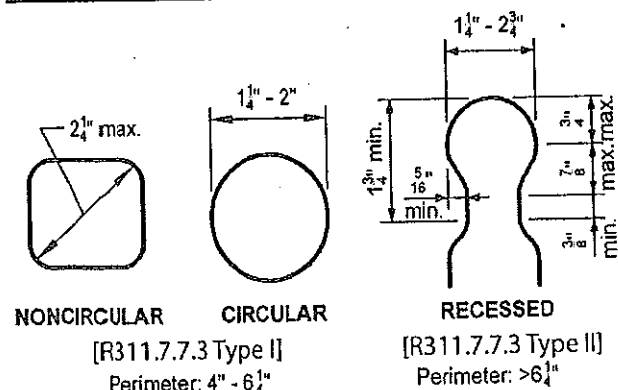


Figure 32B. Handrail Grip Size



STAIR FOOTING REQUIREMENTS [R403]

Where the stairway meets grade, attach the stringers to the stair guard posts as shown in Figure 34. Posts shall bear on footings. All footings shall bear on solid ground and shall be placed at least 12 inches below the undisturbed ground surface or below the frost line, whichever is deeper (see Figure 34). Stringers shall bear on a 2x4 bearing block attached to the post as shown. Stringers shall not bear on new or existing concrete pads or patios that are not founded below this depth. When guards are not required (see GUARD

REQUIREMENTS), posts may terminate below the bottom tread elevation. Bolts are only required if a guard post is required.

STAIR LIGHTING REQUIREMENTS [R303.6]

Stairways shall have a light source located at the top landing such that all stairs and landings are illuminated. The light switch shall be operated from inside the house. However, motion detected or timed switches are acceptable.

Figure 33. Miscellaneous Stair Requirements

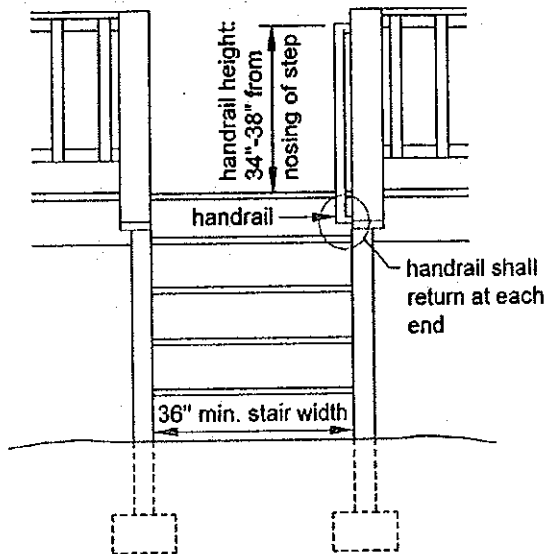
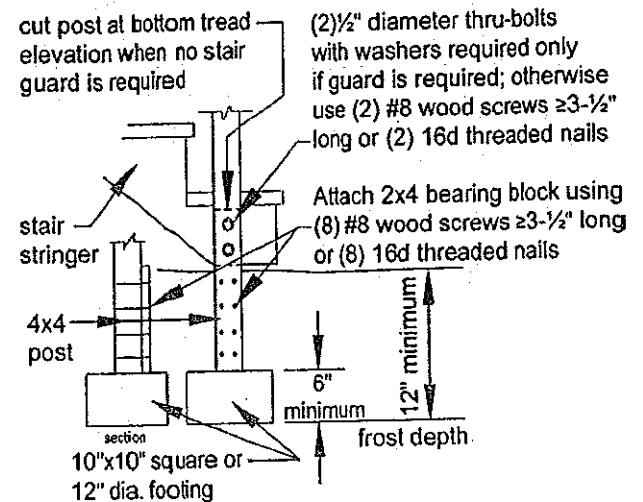


Figure 34. Stair Footing Detail



FRAMING AT CHIMNEY OR BAY WINDOW

All members at a chimney or bay window shall be framed in accordance with Figure 35. Headers may span a maximum of 6'-0". When a chimney or bay window is wider than 6'-0", one or more 6x6 posts may be added to reduce header spans to less than 6'-0". In such cases, the post footing must meet the requirements in the FOOTINGS section. Headers with a span length greater than 6'-0" require a plan submission. Headers shall be located no more than 3'-0" from the end of the trimmer joist.

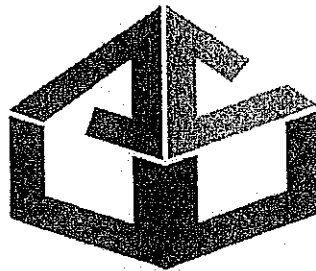
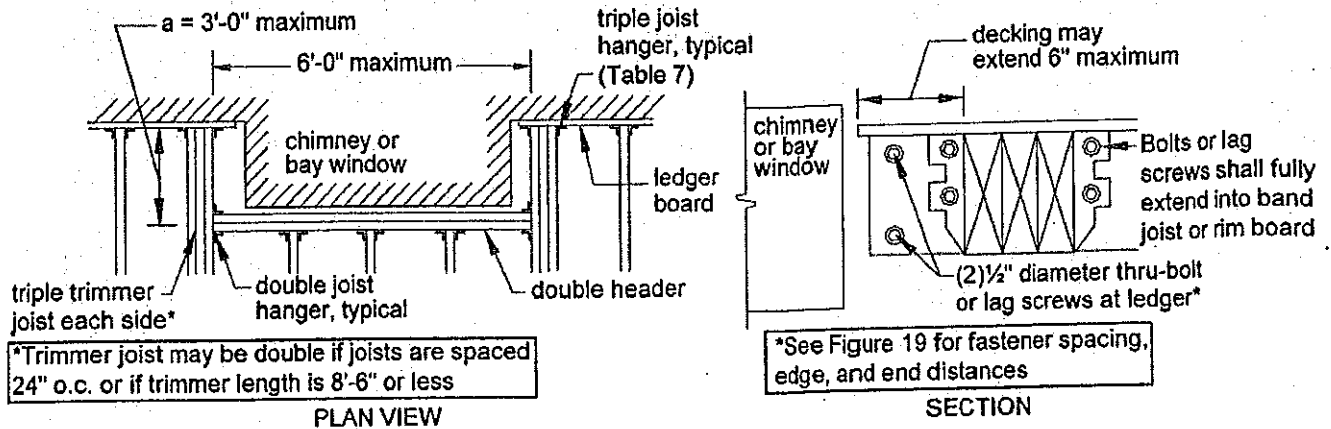
Triple trimmer joists are required on each side of the header if joist spacing is 12" or 16" o.c. or if the trimmer joist span exceeds 8'-6"; otherwise, double trimmer joists are permitted. Trimmer joists may bear on the beam and extend past the beam centerline up to $L/4$ as shown in Figures 1A and 2, or the trimmer joist may attach to the side of the beam with joist hangers as shown in Figure

1B. Joist hangers shall each have a minimum download capacity in accordance with Table 7. Bolts or lag screws used to attach the hanger to the ledger shall fully extend through the ledger into the 2-inch nominal lumber band joist (1-1/2" actual) or EWP rim board. Otherwise a freestanding deck is required.

Table 7. Trimmer Joist Hanger Download Capacity

Joist Size	Minimum Capacity, lbs
2x8	1050
2x10	1380
2x12	1500

Figure 35: Detail for Framing Around a Chimney or Bay Window



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05-13

DECK LATERAL LOAD CONNECTIONS TO MEET THE 2009/2012 IRC FOR MULTIPLE CONDITIONS

SIMPSON
Strong-Tie

Page 2 of 2

Condition C – Floor Joist is a Wood Truss or I-Joist

The DTT2 must be installed on a minimum 2x wood member. Some wood truss and I-joist manufacturers have developed details to attach a horizontal 2x member to their product to transfer a 1,500-lb. lateral load. Contact the manufacturer of the engineered floor component for more information.

Condition D – Top of Deck Steps Down Below Top of Floor

The DTT2 may be installed with as little as 4" of vertical overlap between the floor joist and deck joist depths. Note that the code prescribed connection between the deck ledger and band joist to support gravity loads will require much more overlap. When a step down results in a deck ledger that is attached to a concrete or grout-filled CMU foundation wall, the DTT2 may attach to a ½" diameter anchor rod that is attached to the wall (*ledgers are not permitted to be supported by stone or masonry veneer*). The anchorage and the wall should be designed to support a 1,500-lb. lateral load (see Figure 5).

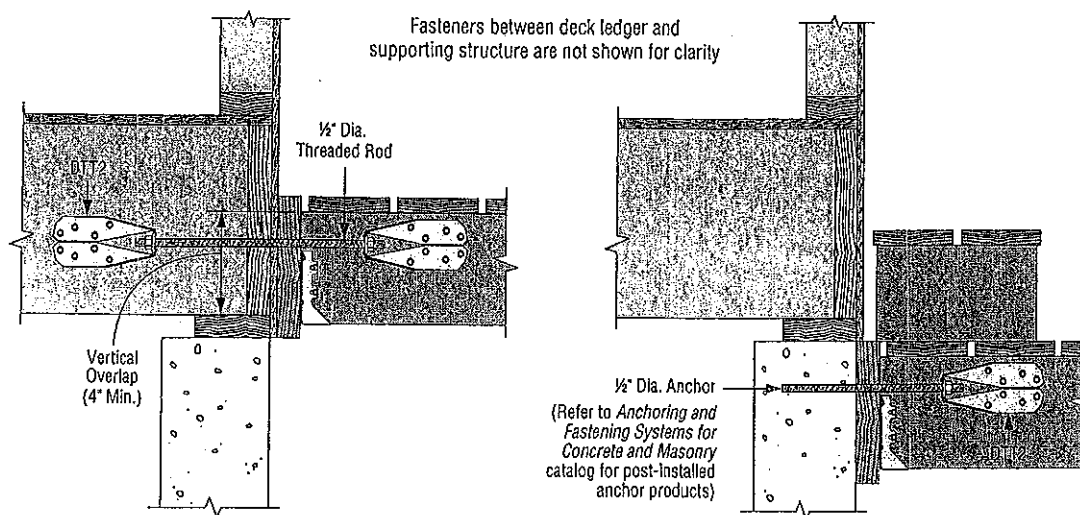


Figure 5

Condition E – No Access to the Top of the Floor Sheathing

When the floor sheathing to joist nailing specified in the IRC cannot be installed, an alternate connection capable of transferring 1,500 lbs. to the floor sheathing is required. Simpson Strong-Tie has evaluated the A35 framing angle installed with SPAX® #6 x ½" pan head, full-thread screws* in ½" minimum plywood or OSB sheathing. The installation shown in Figure 6 has an allowable lateral load of 425 lbs. per A35 (*based on a 3.0 factor of safety*). Use four A35 framing angles to meet the 1,500-lb. requirement. When fastened to full-height blocking (see Condition B), use at least two A35 framing angles on each block.

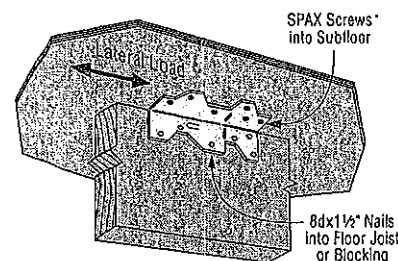


Figure 6

Condition F – No Access to Floor Joist

Where a positive connection to the primary structure cannot be made or verified during inspection, the IRC requires the deck to be self supporting.

Summary

The IRC provides an approved method to resist the lateral loads that can result from wind-, seismic- or occupant-related forces acting on a deck when it is supported by attachment to a ledger. However, as demonstrated not all framing conditions are addressed. When the conditions listed here exist, consider the versatile DTT2 holdown to transfer lateral loads to the supporting structure. Refer to the current *Wood Construction Connectors* catalog for holdown installation information.

*Call (888) ABC-SPAX for local availability of SPAX #6 x ½" pan head, full-thread screw (part #0111010350135).

This technical bulletin is effective until June 30, 2013, and reflects information available as of May 1, 2011. This information is updated periodically and should not be relied upon after June 30, 2013; contact Simpson Strong-Tie for current information and limited warranty or see www.strongtie.com.

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T-DECKLTL0011: 5/11 exp. 6/30/14

Available Threaded Rod Sizes

Model No.	Dia. (in.)	Length (in.)	Finish
ATR½x18HDG	½	18	HDG
ATR½x36HDG	½	36	HDG
ATR½x18SS	½	18	Stainless Steel
ATR½x36SS	½	36	Stainless Steel

800-999-5099
www.strongtie.com

DECK LATERAL LOAD CONNECTIONS TO MEET THE 2009/2012 IRC FOR MULTIPLE CONDITIONS

Background

When decks are supported by attachment to an adjacent structure, the International Residential Code® (2000 through 2012 IRC) requires a positive attachment to that structure to resist lateral (horizontal) loads. These loads can result from wind or seismic forces acting on a deck or from occupants on the deck moving around. If the band joist, deck ledger or deck joists were to pull away from the primary structure as a result of lateral forces, the deck would not be supported for gravity (vertical) loads and would likely collapse (see Figure 1).

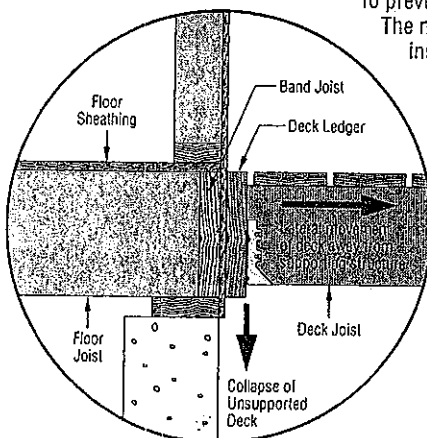


Figure 1

To prevent this, the 2009 and 2012 IRC include an approved method to resist these lateral loads. The method calls for holdown devices with a minimum allowable load of 1,500 lbs. to be installed in at least two locations per deck. The holdowns connect a deck joist to a floor joist in the supporting structure that is nailed to the floor sheathing above (see Figure 2).

The Simpson Strong-Tie® DTT2 deck tension tie may be used in this critical connection assembly to satisfy the provisions of the IRC and the AF&PA *Prescriptive Residential Wood Deck Construction Guide* (DCA6). Versatile and cost-effective, the DTT2 fastens quickly and easily using Simpson Strong-Tie Strong-Drive® SDS screws, which install with no pre-drilling and are included with each DTT2 connector. The DTT2 is available in ZMAX® coating (DTT2Z) and stainless steel (DTT2SS).

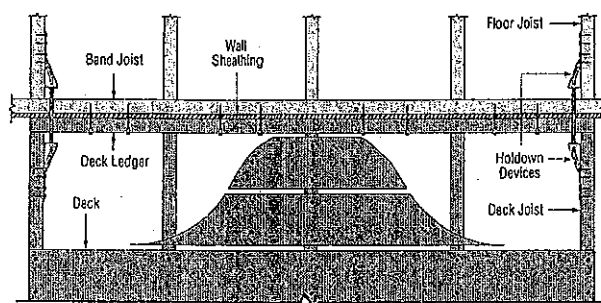


Figure 2

Conditions Not Shown in the IRC

The 2009/2012 IRC detail does not specifically address some common framing conditions. When these are encountered, alternate methods of construction must be approved by the building official to ensure they satisfy the intent of the code and are at least equivalent to the prescribed method. Several alternate construction methods are shown here and are subject to approval by the building official.

Condition A – Floor Joist Framing Does Not Line Up with the Deck Joist

The DTT2 may be installed with a maximum allowable offset of 1½" when the ties are installed at least 18" apart. Larger offsets may require an additional deck joist be added to line up with the floor joist (see Figure 3).

Condition B – Floor Joist Framing is Perpendicular to the Deck Joist

Full-height blocking between joists is a common construction method when lateral load is applied perpendicular to floor framing. The blocking for this application would have to extend into the floor framing far enough to permit enough fasteners from the floor sheathing to transfer 1,500 lbs. An 8d common nail (0.131" x 2½") through ¾" wood structural-panel floor sheathing (G = 0.50) into SPF or better blocking (G ≥ 0.42) has an allowable lateral design value of 131 lbs. (1.60 load duration factor*). This installation would require 12 nails through the floor sheathing into the blocking. It is recommended the blocking extend into the floor at least two joist bays and the DTT2 be installed in the furthest blocked bay (see Figure 4). When nails into the floor sheathing cannot be installed, see Condition E.

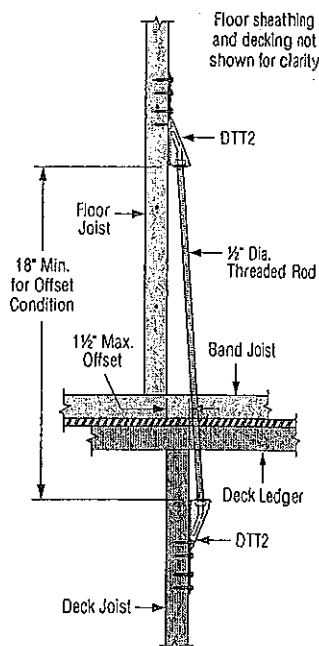


Figure 3

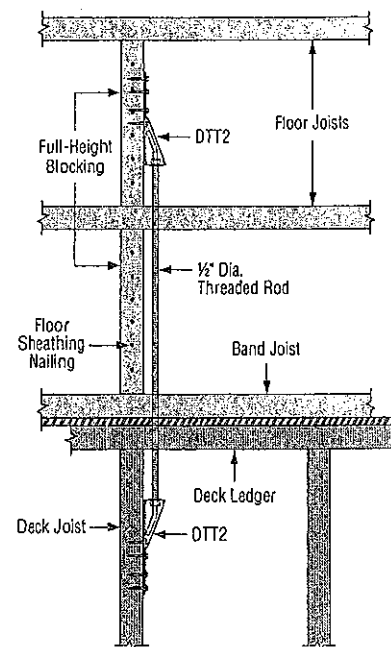


Figure 4

* A load duration factor of 1.60 corresponds to a 10-minute duration of maximum load, adjust for other durations.

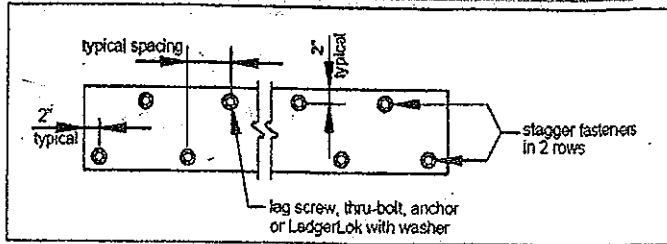


FIGURE 19: LEDGER BOARD FASTENER SPACING AND CLEARANCES

TABLE 4: LEDGER BOARD FASTENER SPACING

Joist Span	Fastener spacing, on center		
	Lag Screws*	LedgerLok*	Thru-bolts, Expansion Anchors, Epoxy Anchors*
0 - 6'-0"	30"	16"	36"
6'-1" - 8'-0"	23"	12"	36"
8'-1" - 10'-0"	18"	10"	34"
10'-1" - 12'-0"	15"	8"	29"
12'-1" - 14'-0"	13"	7"	24"
14'-1" - 16'-0"	11"	6"	21"
16'-1" - 18'-0"	10"	5"	19"

*See Sheet 10 for fastener specifications.



Fairfax County
VIRGINIA

Typical Deck Details

Based on the 2003 Virginia Uniform
Statewide Building Code
www.fairfaxcounty.gov/decks

Revised 2003.11, updated 10/06

Sheet 9 of 18

TABLE 4: LEDGER BOARD FASTENER SPACING

Joist Span	Fastener spacing, on center		
	Lag Screws*	LedgerLok*	Thru-bolts, Expansion Anchors, Epoxy Anchors*
0 - 6'-0"	30"	16"	36"
6'-1" - 8'-0"	23"	12"	36"
8'-1" - 10'-0"	18"	10"	34"
10'-1" - 12'-0"	15"	8"	29"
12'-1" - 14'-0"	13"	7"	24"
14'-1" - 16'-0"	11"	6"	21"
16'-1" - 18'-0"	10"	5"	19"

*See Sheet 10 for fastener specifications.

Statewide Building Code
www.fairfaxcounty.gov/decks

Revised 2003.11, updated 10/06

Sheet 9 of 18

TABLE R502.2.2.1
FASTENER SPACING FOR A SOUTHERN PINE OR HEM-FIR DECK LEDGER
AND A 2-INCH NOMINAL SOLID-SAWN SPRUCE-PINE-FIR BAND JOIST^{a, e}
(Deck live load = 40 psf, deck dead load = 10 psf)

JOIST SPAN	6' and less	6'1" to 8'	8'1" to 10'	10'1" to 12'	12'1" to 14'	14'1" to 16'	16'1" to 18'
Connection details	On-center spacing of fasteners ^{d, e}						
2-inch diameter lag screw with $1\frac{5}{32}$ inch maximum sheathing ^a	30	23	18	15	13	11	10
2-inch diameter bolt with $1\frac{5}{32}$ inch maximum sheathing	36	36	34	29	24	21	19
2-inch diameter bolt with $1\frac{5}{32}$ inch maximum sheathing and $\frac{1}{2}$ inch stacked washers ^{b, h}	36	36	29	24	21	18	16

^a 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

^b The tip of the lag screw shall fully extend beyond the inside face of the band joist.

^c The maximum gap between the face of the ledger board and face of the wall sheathing shall be $\frac{1}{2}$ inch.

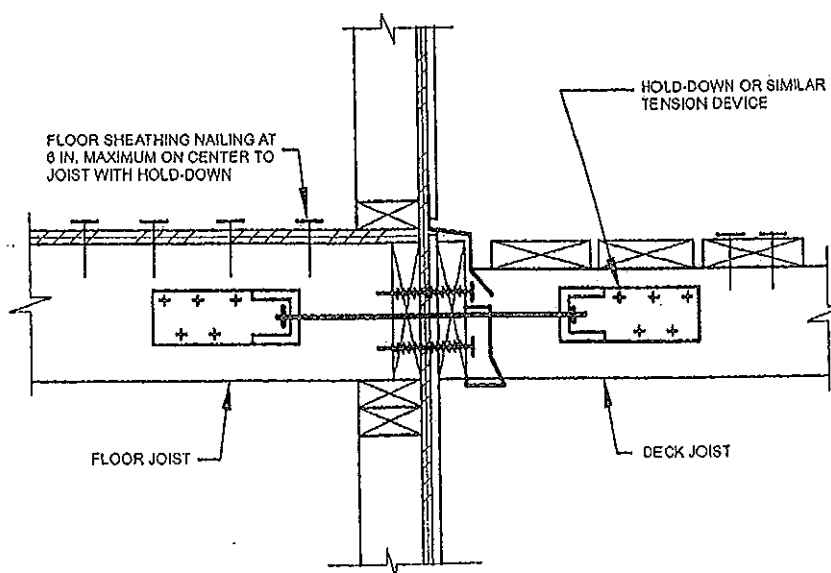
^d Deck ledgers shall be flashed to prevent water from contacting the house band joist.

^e Lag screws and bolts shall be staggered in accordance with Section R502.2.2.1.1.

When solid-sawn pressure-preservative-treated deck ledgers are attached to a minimum 1 inch thick engineered wood product (structural composite lumber, laminated veneer lumber or wood structural panel band joist), the ledger attachment shall be designed in accordance with accepted engineering practice.

Minimum $1 \times 9\frac{1}{2}$ Douglas Fir laminated veneer lumber rimboard shall be permitted in lieu of the 2-inch nominal band joist.

When structural panel sheathing, gypsum board sheathing or foam sheathing not exceeding 1 inch in thickness shall be permitted. The maximum distance between the face of the ledger board and the face of the band joist shall be 1 inch.



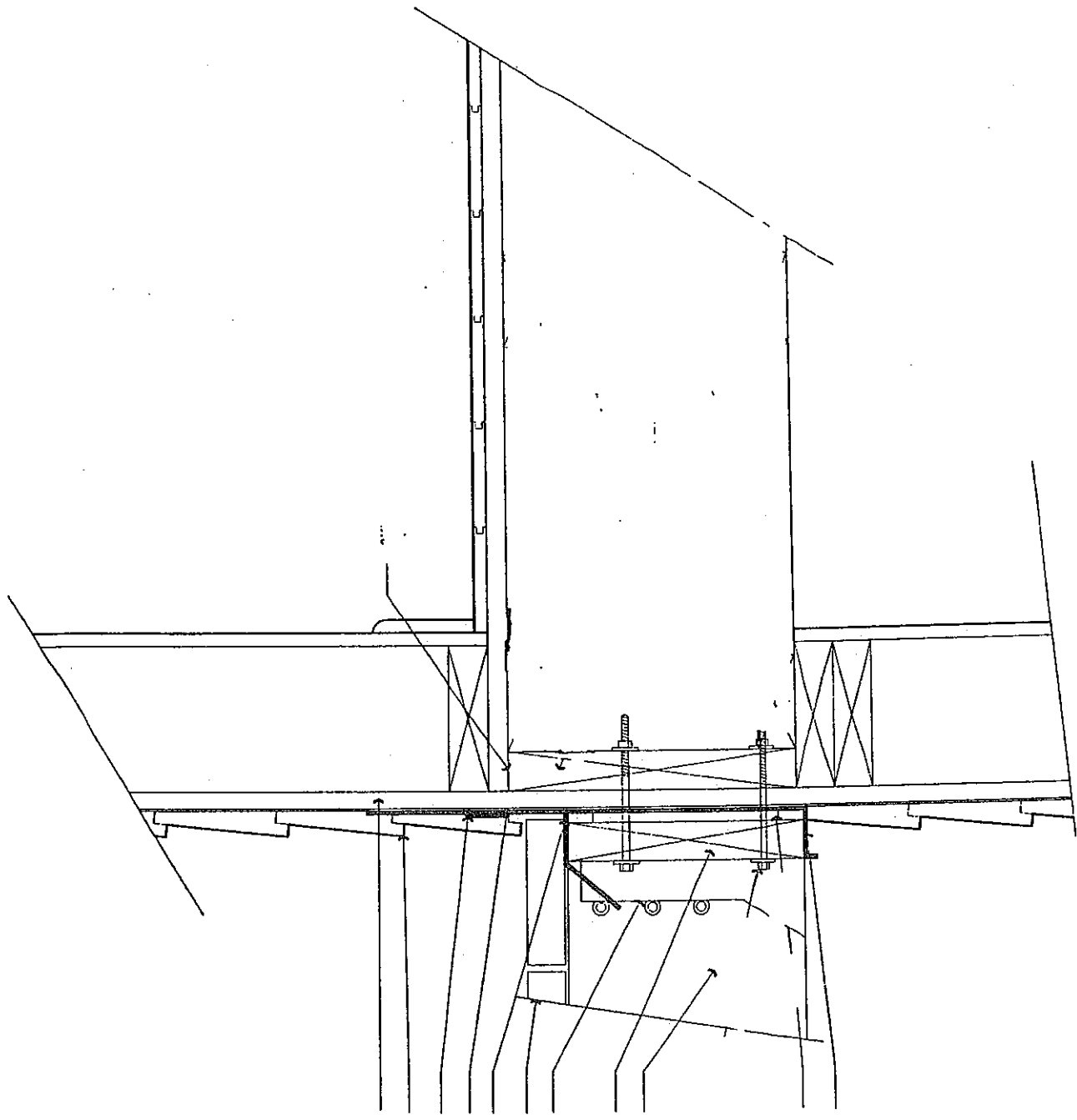
1 inch = 25.4 mm.

FIGURE R502.2.2.3
DECK ATTACHMENT FOR LATERAL LOADS

R502.3 Allowable joist spans. Spans for floor joists shall be in accordance with Tables R502.3.1(1) and R502.3.1(2). For grades and species and for other loading conditions, refer to AF&PA Span Tables for Joists and Rafters.

R502.3.1 Sleeping areas and attic joists. Table R502.3.1(1) shall be used to determine the maximum allowable span of floor joists that support sleeping areas and

attics that are accessed by means of a fixed stairway in accordance with Section R311.7 provided that the design live load does not exceed 30 pounds per square foot (1.44 kPa) and the design dead load does not exceed 20 pounds per square foot (0.96 kPa). The allowable span of ceiling joists that support attics used for limited storage or no storage shall be determined in accordance with Section R802.4.



- EXTERIOR
SHEATHING
SIDING
- Z FLASHING
- TYVEK OR EQUAL
- FLASHING / DRIP
EDGE
- DECKING MATERIAL
- JOIST HANGER:
SIMPSON STRONG
TIE #LUS210
- P.T. LEDGER BOARD
- P.T. DECK JOISTS

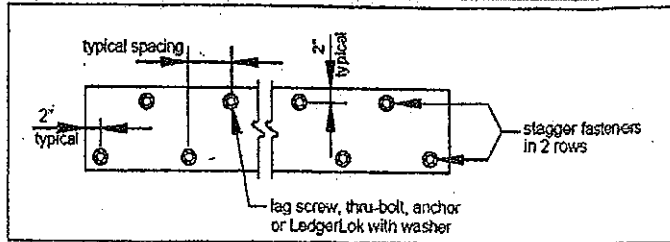


FIGURE 19: LEDGER BOARD FASTENER SPACING AND CLEARANCES

TABLE 4: LEDGER BOARD FASTENER SPACING

Joist Span	Fastener spacing, on center		
	Lag Screws*	LedgerLok*	Thru-bolts, Expansion Anchors, Epoxy Anchors*
0 - 6'-0"	30"	16"	36"
6'-1" - 8'-0"	23"	12"	36"
8'-1" - 10'-0"	18"	10"	34"
10'-1" - 12'-0"	15"	8"	29"
12'-1" - 14'-0"	13"	7"	24"
14'-1" - 16'-0"	11"	6"	21"
16'-1" - 18'-0"	10"	5"	19"

*See Sheet 10 for fastener specifications.



Fairfax County
VIRGINIA

Typical Deck Details

Based on the 2003 Virginia Uniform
Statewide Building Code
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Sheet 9 of 18

TABLE 4: LEDGER BOARD FASTENER SPACING

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	Lag Screws*	LedgerLok*	Thru-bolts, Expansion Anchors, Epoxy Anchors*
0 - 6'-0"	30"	16"	36"
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*See Sheet 10 for fastener specifications.

Statewide Building Code
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Sheet 9 of 18